

*REMARKS/ARGUMENTS*

*The Pending Claims*

Claims 1-21 currently are pending. Claims 1-17 are directed toward a polishing pad comprising a porous polymeric material, wherein the porous polymeric material has a negative Poisson's ratio. Claims 18-21 are directed toward a method of polishing with the aforementioned polishing pad. Reconsideration of the claims is respectfully requested.

*Summary of the Decision on Appeal*

The Decision on Appeal affirmed the grounds of rejection set forth in the Office Action dated January 3, 2008, which are as follows:

(a) Claims 1-7 and 16-20 stand rejected under 35 U.S.C. § 103(a) as allegedly obvious over Reinhardt (i.e., U.S. Patent 6,095,902) in combination with Lakes (i.e., U.S. Patent 4,668,557) and Furukawa et al. (i.e., WO 03/058698 A1 (U.S. Patent Publication 2005/0107007 A1 as English language equivalent));

(b) Claims 8 and 10 stand rejected under 35 U.S.C. § 103(a) as allegedly obvious over Reinhardt in combination with Lakes and Furukawa et al. in further combination with Sevilla et al. (i.e., U.S. Patent 6,126,532);

(c) Claim 9 stands rejected under 35 U.S.C. § 103(a) as allegedly obvious over Reinhardt in combination with Lakes and Furukawa et al. in further combination with Suzuki et al. (i.e., U.S. Patent 6,120,353);

(d) Claims 11-13 stand rejected under 35 U.S.C. § 103(a) as allegedly obvious over Reinhardt in combination with Lakes and Furukawa et al. in further combination with Osterheld et al. (i.e., U.S. Patent 6,241,596); and

(e) Claims 14, 15, and 21 stand rejected under 35 U.S.C. § 103(a) as allegedly obvious over Reinhardt in combination with Lakes and Furukawa et al. in further combination with Tang (i.e., U.S. Patent 5,949,927).

*Discussion of the Obviousness Rejections*

The Office Action rejects all of the pending claims as allegedly obvious over Reinhardt in combination with Lakes and Furukawa et al. alone or in further combination with Sevilla et al., Suzuki et al., Osterheld et al., or Tang. All of the pending claims require, *inter alia*, a chemical-mechanical polishing pad comprising a porous polymeric material, wherein the porous polymeric material has a Poisson's ratio less than 0, i.e., a negative Poisson's ratio.

The Decision on Appeal reasoned that a problem known in the polishing art, i.e., that polishing pads wear over time as a result of use in polishing applications, created a need to develop a polishing pad having improved tear and abrasion resistance properties, such that it would have been obvious to a person of ordinary skill in the art to combine the teachings of Reinhardt, Lakes, and Furukawa et al. to develop a polishing pad comprising a porous polymeric material having a negative Poisson's ratio (see Decision on Appeal, pp. 4, 6, 8). As illustrated by the new evidence submitted in the accompanying "Declaration Under 37 C.F.R. § 1.132 of Abaneshwar Prasad" ("Prasad Declaration"), Applicants respectfully submit that, even assuming that "it [was] well known in the art that superior strength and abrasion resistance [were] desired properties for polishing pads," it would not have been obvious to a person of ordinary skill in the art, nor a matter of routine experimentation, to develop a polishing pad comprising a porous polymeric material having a negative Poisson's ratio (see Decision on Appeal, p. 8). In view of the additional evidence included in the Prasad Declaration, and for the reasons discussed below, the obviousness rejection set forth in the Office Action dated January 3, 2008, and affirmed in the Decision on Appeal, should be withdrawn.

Reinhardt generally discloses porous polishing pads comprising polyether and/or polyester polyurethanes (see, e.g., col. 1, lines 9-49). As discussed in the accompanying Prasad Declaration, all known porous polymeric materials have a positive Poisson's ratio unless they are specially treated so as to convert them into a material having a negative Poisson's ratio (see Prasad Declaration, ¶ 4). Thus, contrary to the reasoning of the Decision on Appeal, Reinhardt discloses porous polymeric materials having *only a positive Poisson's ratio* (see Decision on Appeal, p. 7, reasoning that "the Poisson's ratio of the taught polishing

pads [of Reinhardt] falls into one of three ranges: positive, zero, or negative”). None of the materials disclosed in Reinhardt is a porous polymeric material having a negative Poisson’s ratio.

The Office Action reasons that Lakes “discloses a method of making polymeric foams that have negative Poisson’s ratios and teaches that the negative Poisson’s ration [*sic*, ratio] polymeric foams can replace polymeric foams having positive Poisson’s ratios in many applications to provide improved properties” (Office Action, p. 2; see also Decision on Appeal, pp. 4-5, 7). Even though Lakes does not disclose the use of a negative Poisson’s ratio material in chemical-mechanical polishing applications, the Office Action reasons that “it would have been obvious to one of ordinary skill in the art at the time the invention was made to replace the conventional polyurethane foam of the Reinhardt polishing pad with polyurethane foam having a Poisson’s ration [*sic*, ratio] below zero, to improve strength and abrasion resistance, which are well known in the art as desired properties of polishing pads and will increase the life of the polishing pad, as taught by Furukawa” (Office Action, p. 3, see also Decision on Appeal, pp. 8-10). For the reasons discussed below, Applicants respectfully disagree.

Lakes discloses the preparation of negative Poisson’s ratio materials by subjecting a conventional polymeric foam to triaxial compression in a mold, combined with heating the polymeric foam to a temperature slightly above the softening temperature of the polymeric foam (see, e.g., col. 1, lines 51-61). The compression and temperature conditions necessary to convert a porous polymeric material having a positive Poisson’s ratio to a porous polymeric material having a negative Poisson’s ratio are not consistent with conventional processes for making polishing pads that were known at the time of the claimed invention (see Prasad Declaration, ¶ 6). More specifically, conventional processes that were used to make polishing pads at the time of the claimed invention utilize, for example, (1) polymerization of liquid pre-polymer *in-situ* at polymerization temperatures of below 100° C without the application of pressure, (2) application of a super-critical gas to a polymer sheet to create pores in the polymer at high temperatures and pressures, (3) solid sheet (non-porous) extrusion, (4) sintering, and (5) solvent/non-solvent coagulation (Prasad Declaration,

¶ 6). None of these processes includes – or even approaches – the triaxial compression and temperature conditions necessary for the creation of a negative Poisson’s ratio material.

Consistent with the conventional processes described above, Reinhardt discloses as follows with respect to suitable processes for forming a polishing pad:

The urethane polymers of this invention may be prepared using methods of preparation known to those skilled in the art. In one embodiment, a polyether diol and a polyester diol is added to N,N'-dimethylformamide (DMF) along with a chain extender (for instance 1,4-butanediol.) Equimolar amounts of this combination and diphenylmethane 4,4' diisocyanate (MDI) are reacted to form a mixed ether/ester polyurethane. Preferably 15-40% solids are used, more preferably 20-40% solids. A substrate, such as felt, is coated with a solution of polymer and then the coated substrate is immersed into a bath that causes coagulation of the polymer. Once the polymer has been sufficiently coagulated, the remaining solvent is leached out and the product is dried. The top skin is then removed by passing the material under a blade or under a rotating abrasive cylinder. Once the top skin is removed the underlying pores are exposed and open to the surface.

\* \* \*

In another embodiment, the solid ingredients are mixed, melted, and reacted in a mold to form a cake. The cake is then skived or cut to form polishing pads. Polishing pads may also be formed from the polyester/ether urethane by extrusion, casting, injection molding, sintering, foaming, photopolymerization or other pad formation means.

(col. 1, line 62 – col. 2, line 11; col. 2, lines 43-48). As noted in Reinhardt itself, the methods disclosed are “known to those skilled in the art” (see also Prasad Declaration, ¶ 6).

Thus, even though “Reinhardt is silent on the Poisson’s ratio and does not appear to discourage the use of a negative Poisson’s ratio material,” a person of ordinary skill in the art would not typically utilize the conditions necessary to form a negative Poisson’s ratio material in a process of making a polishing pad, nor would a person of ordinary skill in the art necessarily be able to “routinely experiment to develop a polishing pad, such as taught in Reinhardt, with a negative Poisson’s ratio material” (see Decision on Appeal, p. 8). Nor does Reinhardt provide a person of ordinary skill in the art with any reason to modify the positive

Poisson's ratio of the materials disclosed therein – Reinhardt does not so much as mention the *existence* of Poisson's ratios, let alone recognize the impact of Poisson's ratios on polishing pad materials.

In addition, there were numerous procedures already known in the art to improve pad strength and abrasion resistance properties (see Prasad Declaration, ¶ 7). Thus, a person of ordinary skill in the art would not consider the use of a negative Poisson's ratio material to improve abrasion resistance, especially in view of the unconventional process conditions required to make a negative Poisson's ratio material. Moreover, "superior strength and abrasion resistance" are not properties that are absolutely desirable in all polishing applications – too much abrasion resistance may render the pad resistant to conditioning processes that remove build-up, which can result in loss of polishing activity (Prasad Declaration, ¶ 8). Thus, "abrasion resistance" is not properly considered in a vacuum, and the level of resistance must be tailored to the individual polishing application. A person of ordinary skill in the art would not have known whether the use of a porous polymeric material modified to have a negative Poisson's ratio would provide the appropriate level of abrasion resistance needed for good polishing activity (Prasad Declaration, ¶ 8).

Furthermore, there are several unexpected, beneficial results attendant the claimed invention that confirm its patentability. In particular, because of the unique stress-strain curve of a negative Poisson's ratio material, a polishing pad comprising a porous polymeric material having a negative Poisson's ratio will display greater durability and less deformation than other polishing pads when it is subjected to stresses, including those imposed on the polishing pad during polishing processes (Prasad Declaration, ¶¶ 9-12, 14). In addition, polishing pads comprising negative Poisson's ratio material are self-cleaning, which increases pad durability and pad life (Prasad Declaration, ¶ 13). Lastly, a polishing pad comprising a negative Poisson's ratio material is sufficiently compliant that it is able to distribute concentrated force, but also sufficiently rigid that it will not compress despite the force, thereby reducing "edge-on" effects sometimes observed during chemical-mechanical polishing (Prasad Declaration, ¶ 15).

None of Reinhardt, Lakes, or Furukawa et al. provides a credible reason for one of ordinary skill in the art to have utilized a negative Poisson's ratio material in a chemical-

mechanical polishing pad, let alone to have had a reasonable expectation of success in doing so. Nor do the cited references provide any basis for one of ordinary skill in the art to have reasonably concluded that a polishing pad comprising a porous polymeric material having a negative Poisson's ratio would provide the beneficial properties reported in the present application and the accompanying Prasad Declaration.

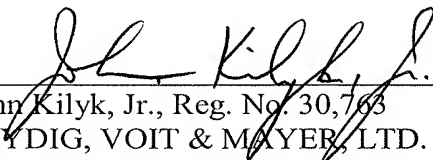
For the reasons discussed previously, each of Sevilla et al., Suzuki et al., Osterheld et al., and Tang fails to cure the deficiencies of Reinhardt, Lakes, and Furukawa et al. vis-à-vis the pending claims (see Applicants' Appeal Brief, April 29, 2008, pp. 6-9).

In view of the foregoing, Applicants respectfully submit that the obviousness rejections are improper and should be withdrawn.

*Conclusion*

If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,



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